

to define what is meant by "moderate use"; probably a quantity of a beverage equivalent to 1 to $1\frac{1}{2}$ fluid ounces of absolute alcohol is as much as can safely be consumed *per diem*. If this be admitted it must be confessed that a large proportion of so-called moderate drinkers exceed the mark; the man who takes four or five whiskies a day is probably consuming 2 to 3 ounces of absolute alcohol *per diem*, and is therefore exceeding what may be considered to be a safe limit. The experiments quoted, in which even weak solutions of alcohol are shown to be protoplasmic poisons, are hardly convincing as to the deleterious action of alcohol on the organism as a whole, for are not distilled water, 3 per cent. salt solution, and beef-tea similarly protoplasmic poisons? A good deal is made of the supposed disastrous effects of alcohol on the nervous system, and it is stated that alcohol is accountable for 20 per cent. of the cases under care in our asylums. Dr. Mott,¹ however, says—and he has made the subject one of special study—that "alcohol does not *per se* produce a permanent mental derangement, such as constitutes our definition of insanity," and he points out that in an American inquiry into the subject, total abstinence was found to be more frequently an antecedent of insanity than was intemperance. These quotations show how difficult it is to associate cause and effect.

Dr. Newsholme deduces from the statistics of the consumption of alcoholic drinks in 1904 that each adult of the working class spends 2s. 2½d. a week on alcoholic beverages; and, assuming that each family spends 5s. a week, this, if placed as an insurance premium, commencing at the age of 25, would mean that the husband would have saved the sum of 422l. at the age of 55, which, invested as an annuity, would yield 12s. 6d. a week. These are certainly figures of grave import, and we would commend them to the politicians, for here surely is the basis for a scheme of old age pensions!

We doubt, however, if there would actually be anything like this saving, for a majority would certainly spend the money on substitutes for alcoholic beverages—tea, coffee, cocoa, milk, and temperance drinks—on better food and clothing, and on amusements, and the actual gain would principally be in the well-being of the people. Finally, incidence of sickness and the percentage death rate among abstainers and non-abstainers is contrasted; among the former the death rate is 3'557, among the latter 6'532. Dr. Newsholme remarks:—"We are compelled to conclude that what is commonly described as moderate drinking has a most injurious effect on health and life." We feel convinced that the whole story is not told by these figures. No doubt many drunkards were included among the moderate drinkers (as Dr. Newsholme suggests), and probably a large proportion were not moderate drinkers according to our definition; and may it not be that a considerable proportion of naturally delicate persons, persons whose stamina is poor and who suffer from various ailments and tend to die young, are moderate drinkers, while the

abstainers include a large proportion of robust individuals who do not feel the need for any alcohol?

On the other hand, a number of so-called abstainers are certainly really moderate drinkers, for many temperance drinks contain some alcohol. Thus, in the year ending March 31, 1907, of 1133 samples of beverages sold as temperance drinks examined in the Government Laboratory, 71 contained 3 per cent. of proof spirit, 37 contained 4 per cent., and 8 contained 6 per cent. or more. Herb beer and dandelion stout contained respectively 10'5 per cent. and 12'3 per cent. of proof spirit. That is to say, 10 per cent. of temperance drinks contain nearly as much alcohol as a mild ale!

The book is well got up, and contains a number of coloured and black-and-white illustrations and diagrams.

VAN DER WAALS AND HIS SUCCESSORS.

Die Zustandsgleichung der Gase und Flüssigkeiten und die Continuitätstheorie. By Prof. J. P. Kuenen. Pp. x+241. (Brunswick: F. Vieweg und Sohn, 1907.) Price 6.50 marks.

PROF. KUENEN'S monograph will be welcomed by a large circle of readers who have felt the fascination of van der Waals's equation in its simple but marvellous exposition of the critical phenomena, and who desire to become acquainted with the results of recent investigations in this important field of work.

As the author is able to show in his first four chapters, the equation of state affords a complete qualitative explanation of the behaviour of gases under varying conditions of temperature and pressure, including those which cause liquefaction. The whole description is admirably clear, but it may be permitted to direct special attention to three points which are not usually discussed; these are (1) the demonstration of the way in which the labile equilibrium (in which pressure and volume increase together) must collapse in such a way as to give rise to two layers of different density (p. 24); (2) the fact that in the metastable region the *p**v* curves for low temperatures intersect and cross the axis of volume, corresponding with the experimental observations of Helmholtz and others that liquids may exist under considerable negative pressures without vaporisation (p. 28); and (3) the fact that the liquid in a capillary tube out of contact from air is under a pressure less than the normal vapour pressure, and is therefore metastable, and might even become labile if the capillary height were sufficiently great.

In spite of its wonderful qualitative accuracy, van der Waals's equation almost invariably breaks down when accurate quantitative tests are applied (chapters vi. to ix.). Thus, if the values of the critical constants are filled in, the expression RT/PV should have the value $8/3=2\cdot67$ for all gas; actually argon appears to give a normal value, and hydrogen the value $2\cdot94$, but a group of eighteen hydrocarbons and simple derivatives gave values ranging from $3\cdot4$ to $3\cdot9$ (p. 60), whilst polymerised liquids gave values between 4 and 5. Similar results are observed in reference to the

¹ *British Medical Journal*, 1907, ii., p. 797.

ratio of the temperature of inversion to the critical temperature; in a number of cases the ratio has the value 2.98, but this figure, though substantially constant, differs considerably from the theoretical value $27/8=3.37$ (p. 68). In a third table (p. 83) are given the minimum volumes for a series of gases under extreme pressure and at low temperatures, as compared with the volumes at the critical point of each gas; the actual values:

O ₂	Cl ₂	CO ₂	SO ₂	C ₂ H ₄	CCl ₄	C ₄ H ₁₀ O	C ₆ H ₆
0.278	0.282	0.269	0.243	0.243	0.260	0.255	0.258

are nearly constant at 0.26, but differ widely from the theoretical value $1/3=0.33$. A fourth table (p. 71), in reference to the minima in the pv/v curves, shows a precisely similar result—the four constants which are given for each of three gases agree closely together, but differ widely from those calculated from the equation of state.

In view of the failure of van der Waals to give an exact quantitative explanation of the behaviour of liquids and gases, it is natural that many attempts should have been made to correct and improve the original equation. These attempts are described in chapters xii. and xiii., but the fact that the author has found it necessary to discuss something like a dozen different equations is in itself sufficient evidence that the goal has not yet been reached.

A part of the difficulty which arises in applying equations such as that of van der Waals is due to the fact that in compounds such as water and the alcohols liquefaction is accompanied by the formation of molecular aggregates (chapter xi.); attention has therefore been directed in recent years mainly to the study of hydrocarbons and similar substances in which this tendency is at a minimum. In most cases the polymerisation is instantaneous, but the author is incorrect in supposing (p. 52) that this is always the case; thus the recent observations of Bamberger and Seligman have shown that in the case of nitrosobutane the association and dissociation (unlike those of nitrogen peroxide) proceed quite gradually. There can be little doubt, however, that he is right in attributing the anomalous densities observed by de Heen and others to the presence of impurities rather than to slow changes of molecular aggregation as postulated by Traube; on this point the evidence afforded by the author's own experiments, supplemented by the recent discussion of Verschaffelt, appears to be conclusive.

T. M. L.

AMERICAN FORAGE CROPS.

Forage Crops for Soiling, Silage, Hay and Pasture.

By Dr. Edward B. Voorhees. Pp. xiii+384. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1907.) Price 6s. 6d. net.

THIS book is one of the Rural Science Series, edited by L. H. Bailey, and designed to give the American farmer simple but accurate instruction in scientific agriculture. Some of the series, e.g. King's "Soil," are of general interest, and are well known here; the others refer mainly to American conditions, and appeal less to English readers.

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Forage crops are those which are fed in the green state to animals instead of being left to ripen and produce seed: turnips, mangolds, and "temporary" grass are all examples. They play a highly important part in every scheme of general farming; indeed, their introduction into England in the seventeenth and eighteenth centuries not only revolutionised our agricultural practice, but had a considerable indirect effect on the social life of our ancestors.

The author deals with practically all the fodder crops grown in the United States, giving details of cultivation and manuring, and, in some cases, summaries of the results obtained with the crop at the various experiment stations. These summaries are perhaps the best part of the book, and will be appreciated both by the student and the farmer; we should like the author to have extended them by including short descriptions of the soil and climatic conditions. The cultivation and manurial details are treated mainly from the empirical standpoint, and here we cannot help feeling that the author has missed an opportunity. Details are of very great importance in agriculture, but they should hardly be given the chief place in a text-book like the present one. Neither the student nor the practical man can make much of them; there is an endless variety about them, and a scheme that works well on one farm may not prove suitable on another close by. What is wanted is a clear statement of the general requirements of the crop, followed by a few well-chosen detailed illustrations. In this way the student gets a real picture that will be of service to him, and the practical man is put in a position to see whether or not he can profitably grow the crop. Unfortunately, the author does not quite give us this, and if the schemes he suggests fail, the farmer is not in possession of the principles which would aid him to frame a modification suited to his land.

A perusal of the book brings out very clearly the differences between English and American practice in regard to fodder crops. The difference depends not only on climate, but also on labour supply, for in the latter respect the American farmer is worse off even than his English cousin. We learn, for instance, that one of our best root crops, the mangold, is not widely grown because of the labour required. Its place is taken by green maize, which is partly fed green and partly made into silage.

The author also deals with the different ways of using fodder crops—soiling, ensilage, and conversion into hay. Soiling was introduced into the States from Europe in the middle of the last century by Josiah Quincy, whose writings on the subject are so good that it is a pity the author makes no mention of him. The practice consists in cutting and carrying green crops to the animals, which are kept in stalls all the year round instead of going out to grass in summer. It has proved to be economical in places where land is dear and labour cheap, but is not likely to displace ensilage in America, notwithstanding the prominent place assigned to it in the book. Indeed, one hardly sees how silage could be improved upon for the American farmer; he has learnt how to make it, and as a